

## Beverage (Carbonated Drinks) - Utilities

Sugar Dissolving

De-aeration

Blending

Pasteurisation

Carbonation

Filling &amp; Packaging

**Utilities**

**Utilities** is the seventh unit in this seven step overview of beverage (carbonated drinks)

### Utilities Process Description

Each utility provides a unique benefit to support the beverage manufacturing process:

- Raw ingredient water
- Clean-in-place (CIP) systems
- Process boilers/steam generation
- Continuous emissions monitoring
- Effluent water treatment

Water is the most widely used ingredient in beverage production. Raw water must be treated to maximise quality and taste as well as remove any contaminants. Reverse osmosis systems maintain a high quality level for ingredient feed water.

CIP systems ensure that all wetted parts remain hygienic and free from contaminants. In addition, CIP cleaning eliminates cross-contamination between different products.

Boilers generate the steam used throughout the production process. The ability to provide and accurately measure the energy used in each operation is critical to produce consistent product with the lowest possible energy cost. The boilers are typically fuelled by natural gas, and accurate measurement of fuel, oxygen, feed water and stack gas emissions optimizes boiler trim and reduces overall emissions.

Boilers can generate air pollutants and many countries require stacks to be continuously monitored for CO, NO<sub>x</sub>, and/or SO<sub>2</sub> levels. Continuous emissions monitoring systems must use reliable, stable sensors that operate continuously. Reports must be generated to address the requirements of local air quality legislation.

Finally, effluent wastewater must be treated prior to discharge to drain.

### Select Critical Control Points of Utilities



**Typical Boiler System**

#### **Raw Water for Ingredient**

Contacting Conductivity determines water for ingredient product quality as well as efficiency of Reverse Osmosis (RO) systems.

#### **CIP Concentration**

Toroidal Conductivity determines strength of cleaning solution, and differentiates between pre-rinse, post-rinse RO treated water, alkaline detergent, acid solution, and product.

#### **CIP Flow Velocity**

CIP fluid velocity is measured to assure adequate turbulence for effective cleaning.

#### **CIP Return Temperature**

The return temperature is measured to assure that the entire circuit was exposed to the minimum required cleaning temperature.

#### **Natural Gas Consumption**

The quality and quantity of Natural Gas provided by the utility is measured to ensure accurate billing and monitoring of usage.

#### **Process Boilers / Steam**

The three primary boiler feeds are natural gas fuel, combustion air and boiler feed water. The flow of these feeds, along with the stack gas emissions are used to optimize the boiler. Steam flow is measured at point of use to determine the efficiency of the process units for energy optimization.

#### **Continuous Emissions Monitoring**


Environmental compliance values must be reported to CO<sub>2</sub> or O<sub>2</sub> diluent corrected levels. All systems should adhere to the latest statutory guidelines if no local environmental laws exist.

#### **Waste Water Effluent Treatment**

To ensure water meets local guidelines pH, CO<sub>2</sub>, DO, and ORP ensure the water discharged meets the local municipality's regulations.







Improving Process Efficiency

Recommended Product Solution

Raw Water for Ingredients	Rosemount Model 403 Conductivity Sensor
<p><b>Control Point Challenge:</b> Contacting conductivity determines water for ingredient product quality as well as efficiency of Reverse Osmosis (RO) systems.</p> <p><b>Solution:</b> Contacting conductivity sensors monitor water pre-membrane and post-membrane. Pre-membrane measurements ensure that the raw water will not damage the membrane media. Post-membrane measurements ensure water for ingredient meets quality specification. Comparison conductivity measurements determine the reverse osmosis system's efficiency. Contacting conductivity sensors accurately monitor below 20 microSiemens/cm.</p>	 <ul style="list-style-type: none"> <li>• &lt;16 microinch Ra surface finish on all wetted parts</li> <li>• NIST traceable calibration constant</li> <li>• Highly accurate RTD for temperature compensation</li> <li>• Highly accurate sensor, &lt;1% error out of the box without calibration</li> </ul>
CIP Concentration	Rosemount Model 225 Toroidal Conductivity Sensor
<p><b>Control Point Challenge:</b> Toroidal Conductivity determines the strength of cleaning solution, and differentiates between pre-rinse, post-rinse RO treated water, alkaline detergent, acid solution and product.</p> <p><b>Solution:</b> Toroidal conductivity sensors differentiate between caustic cleaning solutions, acid cleaning solutions, rinse water and final product / raw ingredients. Sensors must be able to withstand harsh cleaning solutions at elevated temperatures.</p>	 <ul style="list-style-type: none"> <li>• Differentiates between caustic, acid, rinse cycles and product</li> <li>• 3A sanitary approval</li> <li>• Designed to withstand caustic and steam cleaning cycles</li> <li>• Internal RTD for temperature compensation</li> </ul>
CIP Flow Velocity	Rosemount Magmeter
<p><b>Control Point Challenge:</b> Measurement of the CIP fluid velocity to assure adequate turbulence is created to facilitate cleaning.</p> <p><b>Solution:</b> Hygienic magnetic flowmeters provide accurate velocity measurement of CIP fluids in each circuit with no pressure drop and are designed for CIP cleaning to eliminate this as a source of cross contamination.</p>	 <ul style="list-style-type: none"> <li>• Accuracy to 0.25%</li> <li>• Cost effective water measurement</li> <li>• Simple configuration and start-up</li> <li>• Full diameter with low pressure drop and no added shear or turbulence</li> <li>• Low/no maintenance – no moving parts</li> </ul>
CIP Return Temperature	Rosemount 644 Temperature
<p><b>Control Point Challenge:</b> Measurement of the return temperature to ensure that the entire circuit was exposed to the cleaning temperature.</p> <p><b>Solution:</b> Hygienic temperature systems and precision transmitters provide accurate temperature measurement with an easily cleanable sensor.</p>	 <ul style="list-style-type: none"> <li>• Universal RTD/Thermocouple</li> <li>• 4-20mA + HART</li> <li>• 0.03°C accuracy</li> <li>• 2 year stability</li> <li>• Direct mount sensor</li> </ul>


Improving Process Efficiency

Recommended Product Solution

Natural Gas Consumption	Rosemount Analytical Model 700	Micro Motion CMF
<p><b>Control Point Challenge:</b> Accurate monitoring of natural gas consumption.</p> <p><b>Solution:</b> GC-TCD is a proven method to determine BTU level of natural gas for custody transfer. A Coriolis meter may also be used as a check meter to assure accurate utility billing.</p> <p>Cost effective natural gas flow measurement for non custody transfer application in the plant where limited straight run pipe exists by using direct mount conditioning orifice plate requiring two diameters after and before only.</p>	 <ul style="list-style-type: none"> <li>• Ideal for custody transfer</li> <li>• Field mountable</li> <li>• Archives up to 254 item averages, or more than 3 months of standard runs and calculations</li> </ul>	 <ul style="list-style-type: none"> <li>• Mass flow accuracy of 0.35% on gas</li> <li>• Low pressure drop</li> <li>• High turn-down</li> <li>• API certified for custody transfer</li> </ul>
Boiler Natural Gas Flow	Micro Motion CMF100	Rosemount 3051SFA
<p><b>Control Point Challenge:</b> Measurement of the natural gas flow along with the stack gas emissions needed to optimize the boiler.</p> <p><b>Solution:</b> The mass flow rate of the natural gas fuelling the boiler can be very accurately measured by a Coriolis flow meter, and requires minimum straight pipe runs. In applications that are sensitive to pressure drop, an Annubar R compensated DP flowmeter can be used, trading lower pressure drop for a small decrease in mass flow accuracy.</p>	 <ul style="list-style-type: none"> <li>• Mass flow accuracy of 0.35% on gas</li> <li>• Low pressure drop</li> <li>• High turn-down</li> <li>• API certified for custody transfer</li> </ul>	 <ul style="list-style-type: none"> <li>• Accuracy +/- 1.0% of rate</li> <li>• Lowest permanent pressure drop</li> </ul>
Boiler Combustion Air Flow	Rosemount 3051SFA	
<p><b>Control Point Challenge:</b> The measurement of the combustion air flow along with the stack gas emissions needed to optimize the boiler.</p> <p><b>Solution:</b> Mass flow measurement of the combustion air allows for mass balancing the boiler.</p>	 <ul style="list-style-type: none"> <li>• Accuracy +/- 1.0% of rate</li> <li>• Suitable for pipes and ducts</li> <li>• Lowest permanent pressure drop</li> </ul>	
Boiler Feed Water Flow	Rosemount Vortex 8800CR	
<p><b>Control Point Challenge:</b> The measurement of the feed water flow along with the stack gas emissions needed to optimize the boiler.</p> <p><b>Solution:</b> Vortex flowmeters are economical, accurate meters for demineralised water, which typically has too low a conductivity to be accurately measured by magnetic flowmeters. Reducer vortex reduces installed cost.</p>	 <ul style="list-style-type: none"> <li>• Accuracy +/- 0.65% of rate</li> <li>• Reducer option lowers risk and costs</li> </ul>	

**Improving Process Efficiency**

**Recommended Product Solution**

Steam Availability / Boiler Efficiency	Rosemount Analytical MicroCEMS	Rosemount Analytical Oxymitter
<p><b>Control Point Challenge:</b> Optimize boiler efficiency and minimize operational expenditures.</p> <p><b>Solution:</b> Accurate CO and O<sub>2</sub> monitoring at the boiler improves control by eliminating long lag times due to running samples to temperature controlled shelters. Field mountable systems allow operators to adjust boilers with real-time data. If O<sub>2</sub> measurement is sufficient to tune the boilers, then in situ, zirconium oxide based O<sub>2</sub> probes provide a cost effective solution.</p> <p>Accurate and reliable drum level measurement by using high accuracy and long term stability dp level transmitter to maintain steam production and increase boiler availability, reducing non scheduled shut downs.</p> <p>Lowest permanent pressure loss and accurate steam flow measurement for boiler control and efficiency calculation by using Multivariable transmitter with Annubar™ direct mount.</p>	 <ul style="list-style-type: none"> <li>• Proven, reliable paramagnetic O<sub>2</sub> and NDIR CO sensors</li> <li>• Field-mountable, real-time process information at control point</li> <li>• Improved data availability with Ethernet Network Web-browser with Windows network PC</li> </ul>	 <ul style="list-style-type: none"> <li>• Field-mountable, real-time process information at control point</li> <li>• Proven Zirconium Oxide sensor to fine tune boilers</li> <li>• Ideal for high temperature applications</li> <li>• Advanced diagnostics to determine plugging, calibration</li> </ul>
<p><b>Control Point Challenge:</b> Environmental compliance values must be reported to CO<sub>2</sub> or O<sub>2</sub> diluent corrected levels.</p> <p><b>Solution:</b> Pollution emitting stacks must be continually monitored per local air board regulations. Key measurements include carbon monoxide, oxides of nitrogen, sulphur dioxide, and these must be diluent corrected to either a carbon dioxide or oxygen value. Numbers are reported on a time weighted average, and reports must be generated per local regulations.</p>	 <ul style="list-style-type: none"> <li>• EPA approved methodologies to monitor O<sub>2</sub>, NOx, CO, CO<sub>2</sub> and SO<sub>2</sub></li> <li>• System compliant to EPA 40CFR60 Part 75</li> <li>• Windows network PC</li> <li>• Built in data acquisition system stores 90 days of data</li> </ul>	<p><b>Rosemount 3051S</b></p>  <ul style="list-style-type: none"> <li>• dP with remote seals</li> <li>• +/- 0.065% accuracy</li> <li>• 4-20mA + HART</li> <li>• Tuned capillary system</li> <li>• 5 years stability</li> </ul> <p><b>Dp Flow Rosemount 3095 Mass Probar</b></p>  <ul style="list-style-type: none"> <li>• 1.0% mass flow rate accuracy</li> <li>• Five year stability</li> <li>• Real-time fully compensated mass flow</li> <li>• HART output</li> <li>• P/DP/T measurement in a single unit</li> </ul>

Improving Beverage Efficiency

Recommended Product Solution

Waste Water Effluent Treatment

**Control Point Challenge:** Ensure water meets guidelines for pH, CO<sub>2</sub>, DO and ORP according to local regulations.

**Solution:** High BOD waste is treated using anaerobic digestion, controlled aeration and sand filters before being combined with effluent from reactors, mixing tanks and process rinse water in a central wastewater facility. Common processes – such as clarification and sludge removal, chlorination and dechlorination – are then used to prepare the wastewater for release and ensure adequate treatment pH, ORP, chlorine residual, ozone, turbidity and dissolved oxygen are monitored. Residual chlorine measurement ensures final disinfection of the water per environmental guidelines.

Rosemount Analytical Model 499A Sensors



DO, Ozone and Chlorine

- Highly accurate measurements
- Reagent-free amperometric measurements
- Air blast cleaner or a floating ball minimize maintenance time for sensors in coating applications
- Easy to maintain
- Prefabricated systems available

Rosemount Analytical Model 396 TUpH Sensors



- Highly accurate and stable pH readings
- Long lasting sensors
- Multiple configurations for high temperature, high solids, or coating applications
- Advanced diagnostics to monitor sensor's health
- Internal RTD for temperature

Rosemount Analytical Model 1055T Turbidity



- EPA and ISO approved methods
- Easy to calibrate
- 0-200 NTU
- Intuitive, user-friendly menu